PATENT ABSTRACTS OF JAPAN

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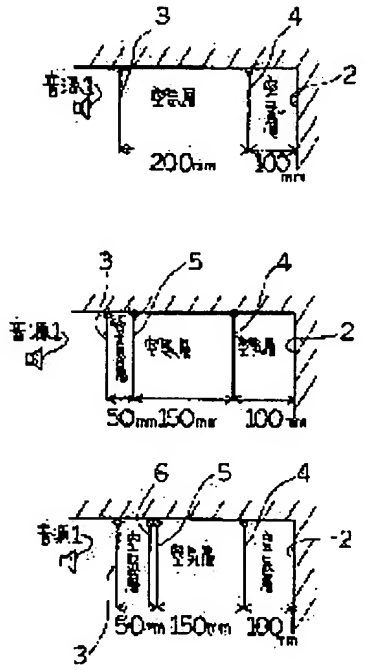
(71)Applicant : KOBE STEEL LTD
(72)Inventor : KIMURA YASUMASA
TANAKA TOSHIMITSU

(54) SOUND ABSORBING STRUCTURE

(57)Abstract:
PURPOSE: To improve the sound absorptivity in a wide frequency range by forming an air layer of thickness size, which attenuates the frequencies of plural sounds respectively, behind and arranging plural cloths successively to a sound source.
CONSTITUTION: A curtain 3 is installed so as to form an air layer, for example, 300mm behind a wall surface 2 facing the sound source 1, the air layer is f6rmed 100mm behind the wall surface 2, and the curtain 4 which is relatively thick and has a large flow resistance value is installed. Similarly, a curtain 5 as a 2nd layer is installed so as to form an air layer 50mm behind the curtain 3. In this case, a thin curtain 6 made of, for example, lace is installed in front of the curtain 5 installed as the 2nd layer while almost superposed to slightly increase the flow resistance value, and then the sound absorptivity in a high frequency range is further improved. At this time, the respective curtains are suspended between the sound source 1 and wall surface 2 by, for example, curtain rails to improve the handling.



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[Date of extinction of right]	

* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] Absorption-of-sound structure characterized by installing two or more cloth to a sound source as the air space of a thickness dimension which may attenuate the frequency of two or more sounds made applicable to absorption of sound, respectively could be formed back.
[Claim 2] Absorption-of-sound structure according to claim 1 which comes to install two or more above-mentioned cloth in the order from what to the large thing has a small flow resistance value side by side from a sound-source side.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the absorption-of-sound structure which can absorb the noise effectively.
[0002]
[Description of the Prior Art] Conventionally, as this kind of absorption-of-sound structure, the thing of an indication is known by JP,57-196298,A and JP,49-108808,A, for example. It consists of techniques of the indication to JP,57-196298,A by separating spacing in the order from a thing to the thing with a large aperture with the small aperture of a stoma which has a large numerical aperture and has a small numerical aperture, and installing in it two or more absorption-of-sound boards which drilled two or more stomata from which an aperture differs in homogeneity, respectively from a sound-source side. On the other hand, it consists of techniques of the indication to JP,49-108808,A by accumulating two or more granules from which particle size differs in the shape of a layer according to this particle size, respectively. That is, with the technique of an indication, the acoustic material with which property IPI dances differ tends to be complexly used for each above-mentioned official report, and it is going to raise the acoustic absorptivity in an extensive frequency domain.
[0003]
[Problem(s) to be Solved by the Invention] However, with the above conventional absorption-of-sound structures, since the comparatively big member of volume, such as a board and a granule, is used like ****, huge-izing of a dimension, the increment in weight, complication of structure, and causing low lower ** of handling nature further cannot be denied. Then, it is originated in view of the above-mentioned situation, and this invention aims at offer of the absorption-of-sound structure which may raise the acoustic absorptivity in an extensive frequency domain effectively with the configuration which it is very easy and lightweight and is easy to deal with it.
[0004]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, the main means which this invention adopts is the absorption-of-sound structure concerning the point that it installed two or more cloth to the sound source as the place made into the summary could form back the air space of a thickness dimension which may attenuate the frequency of two or more sounds made applicable to absorption of sound, respectively.
[0005]
[Function] In the porous sound absorbing material used for a back air space, preparing generally, about a frequency, when the absorption-of-sound engine performance is expressed on an axis of abscissa for an axis of ordinate, the inclination for an acoustic absorptivity to serve as the maximum and the minimum on a certain specific frequency is in it in an acoustic absorptivity (refer to drawing 2 (A)). The frequency which shows this maximal value is determined by the back air bed depth of acoustic material. That is, about the standing wave of the frequency on which an air bed depth is equivalent to quarter-wave length, since the location where particle velocity becomes max, and the location of acoustic material are in agreement, the remarkable absorption-of-sound effectiveness will be acquired. It is possible to improve depression of an acoustic absorptivity by setting the air space which is equivalent to the quarter-wave length of the frequency (** in this drawing) which depression produces in an acoustic absorptivity in 1 lamination using this, and installing cloth, such as a curtain, in the location at ****** (refer to drawing 1 (A) and drawing 2 (B)). It can respond similarly to the depression part of other acoustic absorptivities. In addition, only by installing cloth in a multilayer side by side in this case, since reflection of an acoustic wave takes place on the front

face of the cloth of the 1st layer seen from the sound-source side, the property of the cloth which is back is fully unutilizable. Although it absorbs sound enough about the sound of a low frequency when cloth especially with a thick large flow resistance value is used for the 1st layer, it is tended to reflect the sound of a high frequency. Then, if it arranges sequentially from thin cloth with a small flow resistance value, reflection can be prevented as much as possible and a high acoustic absorptivity can be more effectively obtained in an extensive frequency region.

[0006]

[Example] Below, with reference to an accompanying drawing, it explains per [which materialized this invention] example, and an understanding of this invention is presented. In addition, the following examples are examples which materialized this invention, and are not the things of the character which limits the technical range of this invention. The outline block diagram of the absorption-of-sound structure which drawing 1 requires for one example of this invention here, the graph which shows the relation of an acoustic absorptivity and a frequency, the important section perspective view showing an example of the cloth with which drawing 3 constitutes the above-mentioned absorption-of-sound structure, and drawing 4 are graphs which show the relation of the acoustic absorptivity and the frequency at the time of using the cloth structure shown in drawing 3 . [in / in drawing 2 / the above-mentioned absorption-of-sound structure] As the absorption-of-sound structure concerning this example can form back the air space of a thickness dimension which may attenuate the frequency of two or more sounds made applicable to absorption of sound, respectively, it is constituted by installing two or more curtains (cloth) to a sound source. In addition, a higher acoustic absorptivity can be obtained by installing two or more above-mentioned cloth in the order from what to the large thing has a small flow resistance value side by side from the above-mentioned sound-source side in this case. Hereafter, based on drawing 1 and drawing 2 , the example of the above-mentioned absorption-of-sound structure is explained. First, when a curtain 3 is installed so that a 300mm back air space can be formed as opposed to a sound source 1 and opposite ****** 2 as shown in drawing 1 (A), as shown in drawing 2 (A), depression of an acoustic absorptivity appears in the parts of **, **, and **, and it becomes clear that the first peak exists near the frequency (it is f**280Hz from c=flambda) from which 300mm of back air spaces serves as quarter-wave length. In addition, as the above-mentioned curtain 3, it is close to the blanket ground, length of hair is long, and the quality of the material with comparatively small flow resistance with still more sufficient permeability is applied here. Then, as are shown in drawing 1 (A), and a 100mm back air space can be formed to the above-mentioned wall surface 2, the curtain 4 with a big flow resistance value is comparatively installed with thick. This sets the optimal air space as 100mm by making into a standard to secure the air space around 140mm which drawing 2 (A) Sets, and is equivalent to the quarter-wave length of this 600Hz standing wave since the frequency corresponding to the depression part of the beginning of an acoustic absorptivity is about 600Hz. Thereby, the graph of drawing 2 (B) shows that depression partial [in drawing 2 (A)] ** and ** are improved.

[0007] Furthermore, in order to aim at an acoustic-absorptivity improvement on the frequency of about 1800Hz equivalent to depression partial ** in drawing 2 (A), as the 50mm back air space could be formed in the above-mentioned curtain 3, the curtain 5 was similarly installed as a two-layer eye. (Refer to drawing 1 (B)) . In this case, the above-mentioned curtains 5 are said curtain 3 and the abbreviation same quality of the material. Thereby, as shown in drawing 2 (C), the acoustic absorptivity in an extensive frequency domain has been improved effectively. In addition, as shown in drawing 1 (C) in this case, the acoustic absorptivity in a 1500-2000Hz high-frequency field is further improved from installing the thin curtain 6 by abbreviation pile ****** with a ball-race background ahead of the above-mentioned curtain 5 installed as a two-layer eye, and making a flow resistance value high slightly (refer to drawing 2 (D)). In addition, in the above absorption-of-sound structures, although the acoustic absorptivity in a low frequency region falls by considering as the PURERU structure where a curtain is shown in drawing 3 , depression of the acoustic absorptivity in a RF region is improved (refer to drawing 4). Thus, when it makes to improve depression of an acoustic absorptivity into the PURERU structure where it is shown that there is little reflection, and the above-mentioned curtain 3 of the 1st layer with which especially absorption of sound in a RF region is demanded is shown in drawing 3 when it considers as multilayer structure which was described above, still more effective absorption-of-sound structure can be offered. Furthermore, in the above-mentioned absorption-of-sound structure, it becomes possible by carrying out the suspension of each above-mentioned curtain with a curtain rail etc. so that the location can be suitably moved between a sound source 1 and a wall surface 2 to offer the absorption-of-sound structure which can make a setting change of the dimension of each back air space suitably and which was further excellent in handling nature.

[0008]
[Effect of the Invention] Since this invention is absorption-of-sound structure characterized by installing two or more cloth to a sound source as the air space of a thickness dimension which may attenuate the frequency of two or more sounds made applicable to absorption of sound, respectively could be formed back as described above, it can raise the acoustic absorptivity in an extensive frequency domain effectively with the configuration which it is very easy and lightweight and is easy to deal with it.

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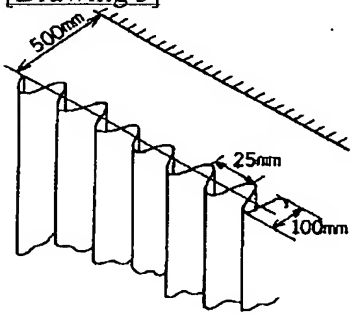
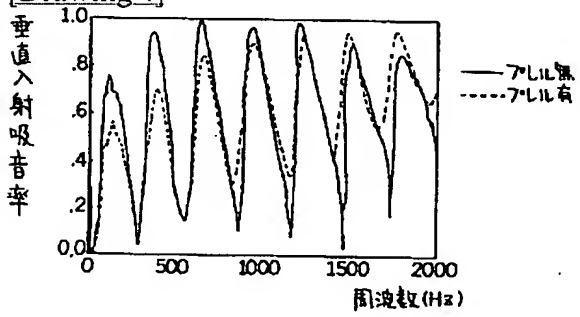
DRAWINGS

[Drawing 3]

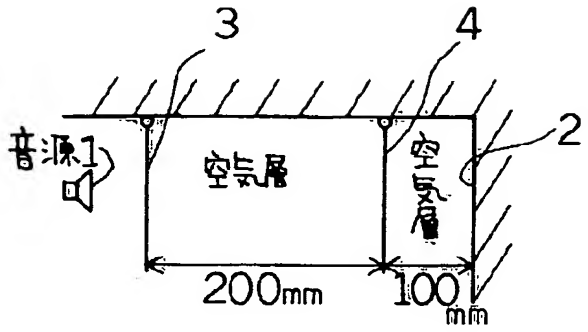


[Drawing 4]



[Drawing 1]

(A)



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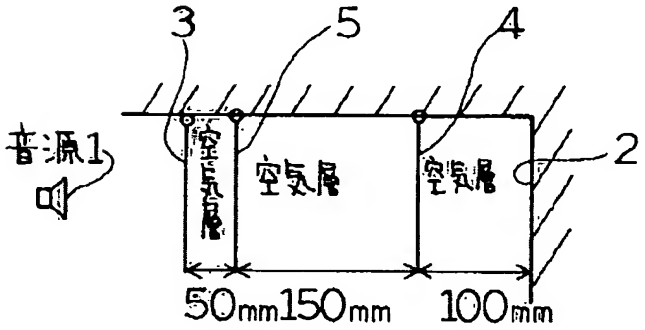

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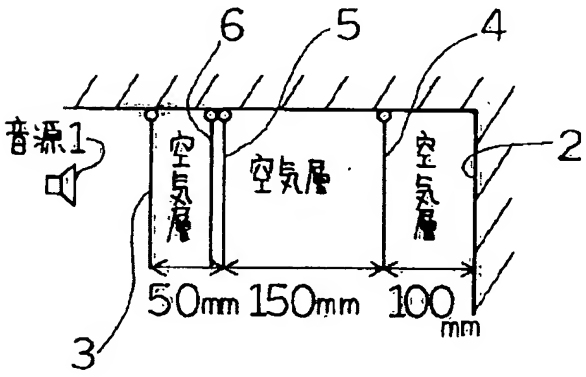
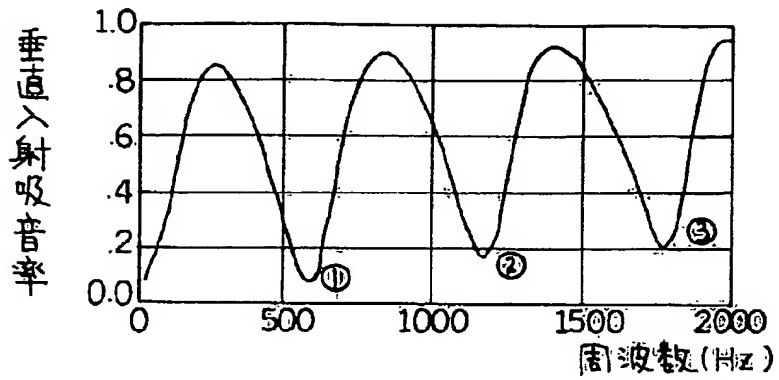


[Drawing 2]

(A)



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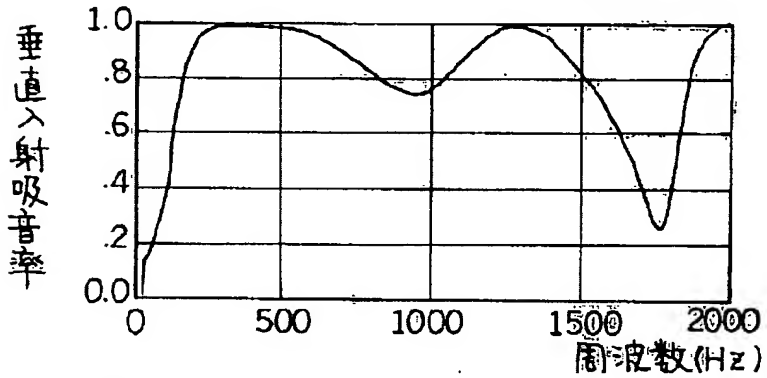

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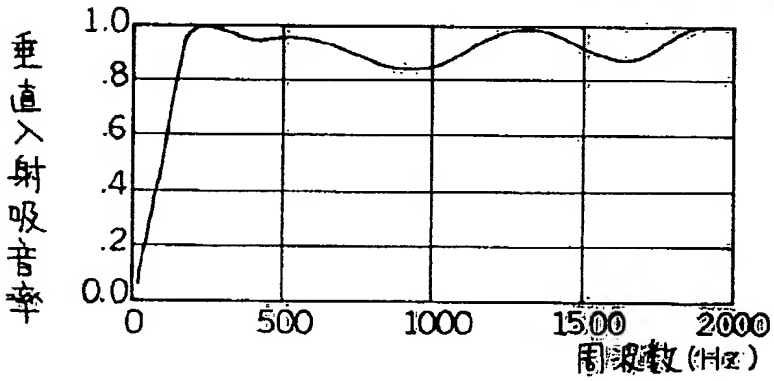
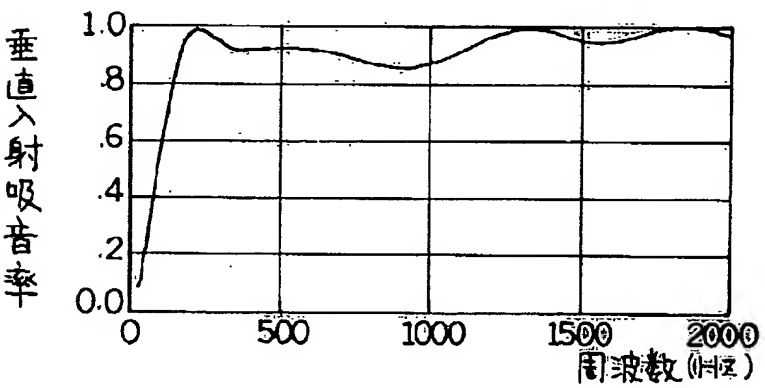


(D)



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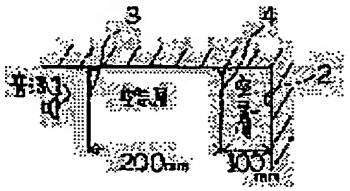

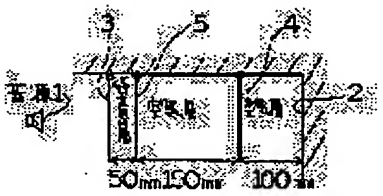

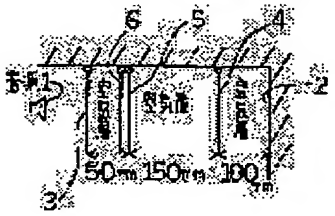

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Ｅ０４Ｂ　1/86		C　7521－2E		

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(74)代理人　弁理士　本庄　武男

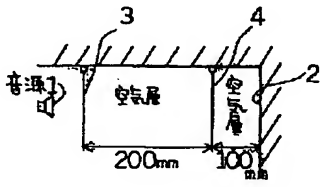
(54)【発明の名称】　吸音構造

(57)【要約】

【目的】　きわめて簡単で取扱い易い構成にて広範な周波数領域での吸音率を効果的に向上させ得る吸音構造の提供。

【構成】　吸音対象とする複数の音の周波数をそれぞれ減衰させ得る厚み寸法の空気層を背後に形成し得るようにして，例えば４枚のカーテン３，４，５，６を音源１に対して並設した。

(A)



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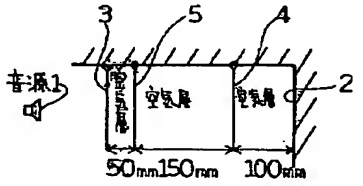

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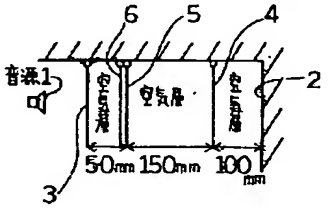

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【特許請求の範囲】

【請求項１】　吸音対象とする複数の音の周波数をそれぞれ減衰させ得る厚み寸法の空気層を背後に形成し得るようにして複数の布を音源に対して並設したことを特徴とする吸音構造。

【請求項２】　上記複数の布を，流れ抵抗値の小さいものから大きいものへの順に音源側から並設してなる請求項１に記載の吸音構造。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は，騒音を効果的に吸収することの出来る吸音構造に関するものである。

【０００２】

【従来の技術】従来，この種の吸音構造としては，例えば特開昭５７－１９６２９８号公報や特開昭４９－１０８８０８号公報に開示のものが知られている。特開昭５７－１９６２９８号公報に開示の技術では，孔径の異なる複数の小孔をそれぞれ均一に穿設した複数枚の吸音ボードを，小孔の孔径が小さく開口率が大きいものから孔径が大きく開口率が小さいものへの順に音源側から間隔を隔てて並設することにより構成されている。他方，特開昭４９－１０８８０８号公報に開示の技術では，粒径が異なる複数の粒状体をこの粒径別にそれぞれ層状に積み重ねることにより構成されている。即ち，上記各公報に開示の技術では，特性インピーダンスの異なる吸音材を複合的に使用し，広範な周波数領域での吸音率を向上させようとするものである。

【０００３】

【発明が解決しようとする課題】ところが，上記のような従来の吸音構造では，上述の如く，ボードや粒状体などの容積の比較的大きな部材を用いているため，寸法の長大化，重量増加，構造の複雑化，更には取扱性の低下等をを来たすことは否めない。そこで，本発明は，上記事情に鑑みて創案されたものであり，きわめて簡単，軽量で且つ取扱い易い構成にて広範な周波数領域での吸音率を効果的に向上させ得る吸音構造の提供を目的とするものである。

【０００４】

【課題を解決するための手段】上記目的を達成するために，本発明が採用する主たる手段は，その要旨とするところが，吸音対象とする複数の音の周波数をそれぞれ減衰させ得る厚み寸法の空気層を背後に形成し得るようにして複数の布を音源に対して並設した点に係る吸音構造である。

【０００５】

【作用】一般に背後空気層を設けて使用される多孔質吸音材では，周波数を横軸に吸音率を縦軸にとって吸音性能を表現すると，ある特定の周波数で吸音率が極大，極小となる傾向がある（図２（Ａ）参照）。この極大値を示す周波数は，吸音材の背後空気層厚みによって決定される。即ち，空気層厚みが１／４波長に相当する周波数の定在波については，粒子速度が最大になる位置と吸音材の位置が一致するため，著しい吸音効果が得られることになる。このことを利用して１層構成では吸音率に落ち込みが生じる周波数（同図中の①）の１／４波長に相当する空気層をおいて，その位置に新らたに例えばカーテン等の布を設置することにより，吸音率の落ち込みを改善することが可能である（図１（Ａ），図２（Ｂ）参照）。他の吸音率の落ち込み部分に対しても同様に対応可能である。尚この場合，単に布を多層に並設しただけでは，音源側からみた第１層の布の表面で音波の反射が起こるため，背後にある布の特性を十分に生かしきれない。特に厚手の流れ抵抗値の大きい布を第１層に用いた場合，低い周波数の音については十分吸音するものの，高い周波数の音は反射する傾向にある。そこで，流れ抵抗値の小さい薄手の布から順に配置すれば，極力反射を防止し，より効果的に広範な周波数域において高い吸音率を得ることが出来る。

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【０００６】

【実施例】以下添付図面を参照して，本発明を具体化した実施例につき説明し，本発明の理解に供する。尚，以下の実施例は，本発明を具体化した一例であって，本発明の技術的範囲を限定する性格のものではない。ここに，図１は本発明の一実施例にかかる吸音構造の概略構成図，図２は上記吸音構造における吸音率と周波数との関係を示すグラフ，図３は上記吸音構造を構成する布の一例を示す要部斜視図，図４は図３に示した布構造を用いた場合に於ける吸音率と周波数との関係を示すグラフである。この実施例に係る吸音構造は，吸音対象とする複数の音の周波数をそれぞれ減衰させ得る厚み寸法の空気層を背後に形成し得るようにして，複数の例えばカーテン（布）を音源に対して並設することにより構成されている。尚この場合，上記複数の布を，流れ抵抗値の小さいものから大きいものへの順に上記音源側から並設することにより，より高い吸音率を得ることができる。以下，図１及び図２に基づいて，上記吸音構造の具体例について説明する。まず，図１（Ａ）に示すように，音源１と対向す壁面２に対して例えば３００㎜の背後空気層を形成し得るようにカーテン３を設置した場合，図２（Ａ）に示すように，吸音率の落ち込みが①，②，③の部分に現れ，背後空気層３００㎜が１／４波長となる周波数（ｃ＝ｆλよりｆ≒２８０Ｈｚ）近辺に最初のピークが存在する事が判明する。尚ここで，上記カーテン３としては，毛布地に近くて毛足が長く，更に，通気性の良い比較的流れ抵抗の小さい材質が適用されている。そこで，図１（Ａ）に示すように，上記壁面２に対して１００㎜の背後空気層を形成し得るようにして，比較的厚手で流れ抵抗値の大きなカーテン４を設置する。これは，図２（Ａ）おいて吸音率の最初の落ち込み部分に対応する周波数が６００Ｈz近傍であることから，この６００Ｈz

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の定在波の１／４波長に相当する１４０㎜前後の空気層を確保することを目安として，最適な空気層を１００㎜に設定したものである。これにより，図２（A）中の落ち込み部分①，②が改善されていることが，図２（B）のグラフよりわかる。

【０００７】さらに，図２（A）中の落ち込み部分③に相当する周波数１８００Hz近傍での吸音率改善を図るため，同様に，上記カーテン３において５０㎜の背後空気層を形成し得るようにして２層目としてカーテン５を設置した。（図１（B）参照）。この場合，上記カーテン５は，前記カーテン３と略同一材質である。これにより，図２（C）に示すように，広範な周波数領域での吸音率が効果的に改善された。尚この場合，図１（C）に示すように，２層目として設置された上記カーテン５の前方に例えばレース地で薄手のカーテン６を略重ねた状態で設置して，流れ抵抗値をわずかに高くすることより，１５００～２０００Hzの高周波数領域での吸音率が更に改善される（図２（D）参照）。尚，上記のような吸音構造においては，カーテンを図３に示すようなプレル構造とする事により，低周波数域での吸音率は低下するものの，高周波域での吸音率の落ち込みが改善される（図４参照）。このように吸音率の落ち込みが改善されるということは反射が少ないことを示しており，前記したような多層構造とした場合，高周波域での吸音が特に要求される第１層目の上記カーテン３を図３に示すようなプレル構造とすると，更に有効な吸音構造を提供しうる事となる。更に，上記吸音構造において，上記各カーテンを音源１と壁面２との間でその位置を適宜移動し得るように例えばカーテンレールなどにて懸架することにより，各背後空気層の寸法を適宜設定変更することのできる更に取扱性に優れた吸音構造を提供することが可能となる。

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【０００８】

【発明の効果】本発明は，上記したように，吸音対象とする複数の音の周波数をそれぞれ減衰させ得る厚み寸法の空気層を背後に形成し得るようにして複数の布を音源に対して並設したことを特徴とする吸音構造であるから，極めて簡単，軽量で且つ取扱い易い構成にて広範な周波数領域での吸音率を効果的に向上させることが出来る。

【図面の簡単な説明】

【図１】　本発明の一実施例にかかる吸音構造の概略構成図。

【図２】　上記吸音構造における吸音率と周波数との関係を示すグラフ。

【図３】　上記吸音構造を構成する布の一例を示す要部斜視図。

【図４】　図３に示した布構造を用いた場合に於ける吸音率と周波数との関係を示すグラフ。

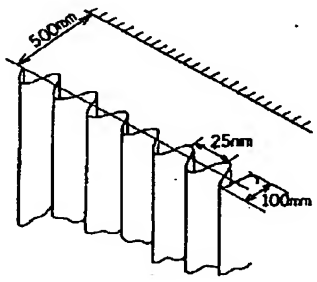
【符号の説明】

１…音源

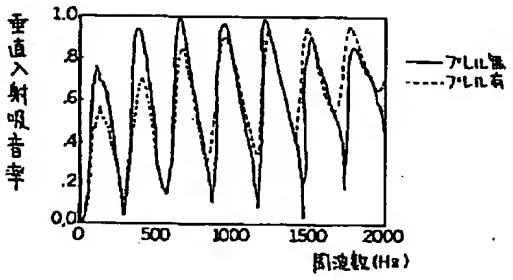
２…壁面

３，４，５，６…カーテン

【図３】

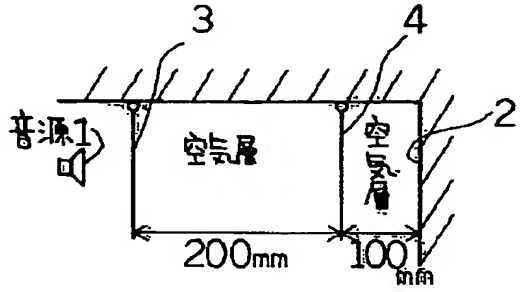


【図４】

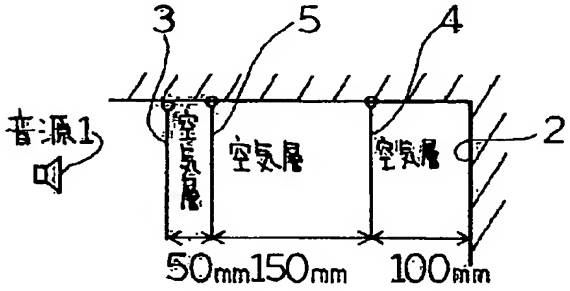


【図１】

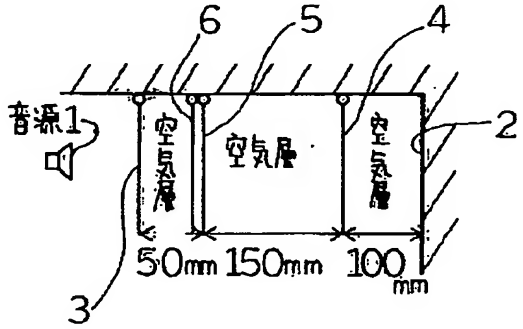
(A)


3
4
2
音源1
空気層
空気層
200mm
100mm

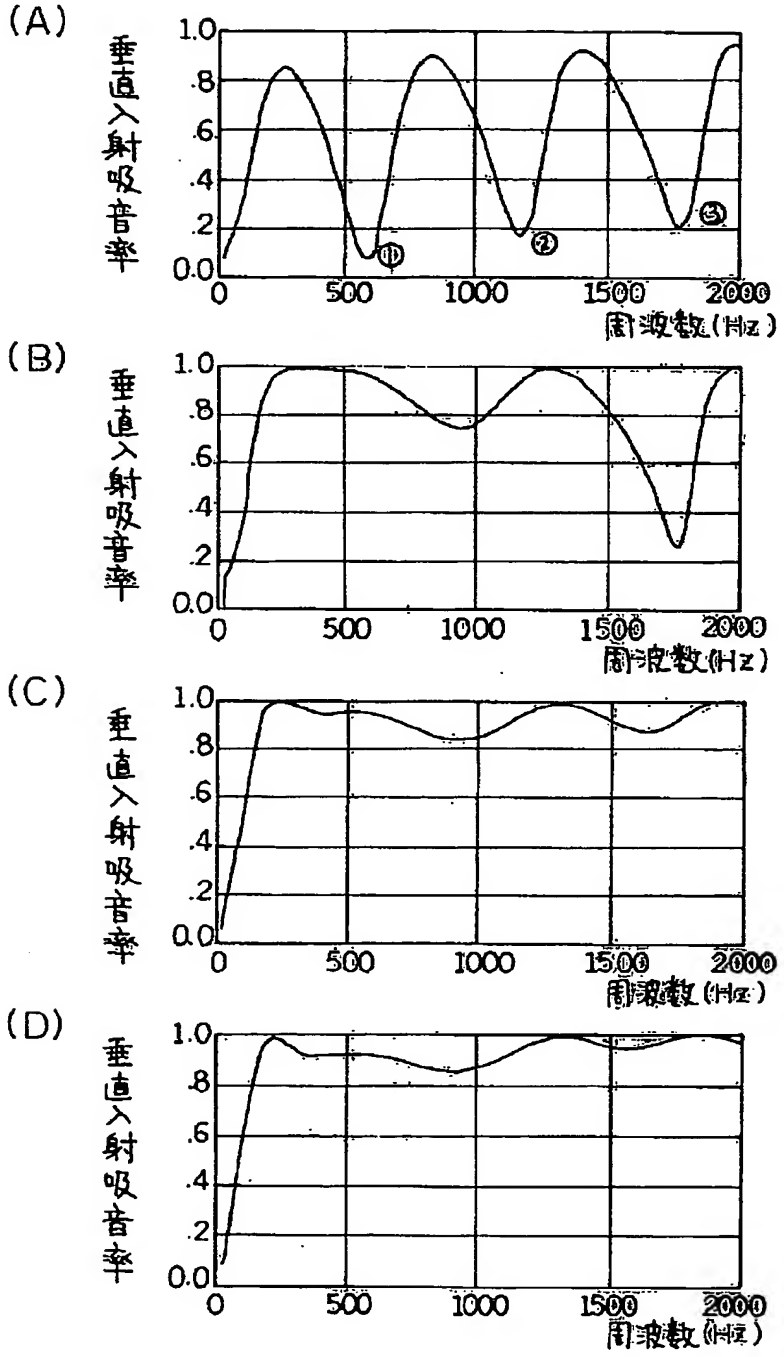
(B)


3
5
4
2
音源1
空気層
空気層
空気層
50mm
150mm
100mm

(C)


6
5
4
2
音源1
空気層
空気層
空気層
50mm
150mm
100mm
3

【図2】


(A)
垂直入射吸音率
1.0
.8
.6
.4
.2
0.0
0
500
1000
1500
2000
周波数(Hz)
①
②
③
(B)
垂直入射吸音率
周波数(Hz)
(C)
垂直入射吸音率
周波数(Hz)
(D)
垂直入射吸音率
周波数(Hz)